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(54) **AIR POLLUTION CONTROL SYSTEM, AIR POLLUTION CONTROL METHOD, SPRAY DRYING DEVICE OF DEWATERING FILTRATION FLUID FROM DESULFURIZATION DISCHARGED WATER, AND METHOD THEREOF**

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This patent is subject to a terminal disclaimer.

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(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,853,514 A 12/1974 Post
4,322,393 A * 3/1982 Gleason B01D 53/501
159/4.02

(Continued)

FOREIGN PATENT DOCUMENTS

CN 101417828 A 4/2009
CN 101918108 A 12/2010

(Continued)

OTHER PUBLICATIONS

International Search Report of corresponding PCT Application No. PCT/JP2012/057037, mailing date Jun. 26, 2012.

(Continued)

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(57) **ABSTRACT**

To include a boiler **11** that burns fuel **F**, an air heater **13** that recovers heat of flue gas **18** from the boiler **11**, a first precipitator **14** that reduces dust in the flue gas **18** after heat recovery, a desulfurizer **15** that reduces sulfur oxides in the flue gas **18** after dust reduction by an absorbent, a dewaterer **32** that reduces gypsum **31** from desulfurization discharged water **30** discharged from the desulfurizer **15**, a spray drying device **34** including an atomizer that atomizes a dewatering filtration fluid **33** discharged from the dewaterer **32**, and a flue-gas introducing line **L₁₁** that introduces a part of the flue gas **18** into the spray drying device **34**.

6 Claims, 22 Drawing Sheets

